THE FIXATIVE POWER OF TRACTION IN THE TREATMENT OF HIP DISEASE.

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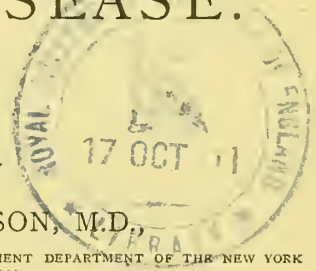

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That traction possesses to a certain degree the power of fixing the joints of the extremities is not a new idea in surgery. It was entertained in the last century by Desault, whose apparatus for fracture of the femur is described as follows: "This consists, to speak in general terms, in taking the points of extension above, on the tuberosity of the os ischium of the diseased side, and below, on the malleoli; in securing the straps or rollers, destined for making extension, on the two ends of a strong splint, placed along the outside of the limb; and in converting, so to speak, the pelvis, the thigh, the leg, and the foot, into one entire and solid piece."[1] In 1835 Lesauvage wrote that one of the objects of continued extension in the treatment of hip disease is to prevent motion.[2] Mr. Liston, seeking to disparage the use of the weight and pulley in the treatment of hip disease, said: "All this may amuse the patient's mind, perhaps, but I do not think any good can come of it further than preventing motion."[3] M. Philipeaux writes, that in the absence of retentive splints, traction may be em-

[1] Treatise on Fractures, p. 243. Translated by Charles Caldwell, M.D. Philadelphia, 1817.

[2] Arch. gén., p. 280. November, 1835.

[3] Lancet, pp. 237, 238. November 25, 1843.

ployed to secure immobility of the limb.[1] Dr. C. Fay, ette Taylor refers to "the quiet fixation of the joint-which the splint has been a convenient means of accomplishing."[2] Dr. Louis Bauer says: "Whatever benefit I have derived from it (extension) is unquestionably due to its collateral effect upon fixing the affected articulation."[3] Mr. Thomas, referring to extension, writes: "In its application it involves, unavoidably, a fractional degree of fixation."[4] Dr. L. M. Yale writes: "When the muscular spasm is urgent, fixation cannot be secured, save by the use of a force as constantly acting as that which is to be overcome, and the agent best adapted to this purpose is traction."[5] Dr. J. A. Wyeth writes: "Extension is made by means of the screw-key, until there is freedom from pain and a comfortable fixation of the limb."[6] Dr. N. M. Shaffer writes: "When traction exists the patient has the advantage of that peculiar and perfect immobility which the extension of the long hip splint affords."[7]

The fixation of the hip-joint is one of the most difficult problems in mechanical surgery.[8] In the first place,

[1] Traité de Thérapeutique de la Coxalgie, p. 285. Paris, 1867.

[2] The Medical Record, p. 290. September 1, 1867.

[3] Lectures on Orthopedic Surgery, p. 282. Second Edition. New York, 1868.

[4] Hip, Knee, and Ankle, p. 10. Third Edition. Liverpool, 1878.

[5] The Medical Record, p. 27. January 12, 1878.

[6] New York Medical Gazette, p. 243. April 17, 1880.

[7] Archives of Medicine, p. 198. October, 1880. The opinion has been expressed by the present writer that "traction, however applied, is unavoidably accompanied by fixation," that "the advantages derived from the traction exerted by the hip splint are due solely to the fact that it secures fixation," and that "fixation is undoubtedly one of the principal functions of the long hip splint." New York Medical Journal, p. 17. July, 1882. St. Louis Courier of Medicine, p. 370. May, 1881. The Medical Record, p. 738. June 26, 1880.

[8] In 1828 Sir Charles Bell said: "No instrument has ever been effectual in keeping the thigh and trunk fixed." London Medical Gazette, p. 139, January 12, 1828.

this articulation is a ball and socket. Aside from this the difficulty is due, in a great measure, to the fact that the hip-joint is situated near the centre of the body. In order to understand the subject clearly, it may be well to take an elementary view of the relation of the muscles to the joints, as follows: The muscular apparatus of a joint has a twofold function. It can at will either move or fix the joint. If the joint be remote from the centre, the muscles will be more effective in their control either for motion or fixation, because of the disproportion in size and weight between the part above and that below the point of motion. There is philosophy as well as humor in Dundreary's witticism: "Why does a dog waggle his tail?" Answer. "Because the tail can't waggle the dog."[1] As the wagging of a dog's tail is not only motion alternately right and left, but also arrest of motion right and left, it is clear that motion and fixation, as effects of muscular action, are correlative, and if the part below the point of motion is more easily moved on account of its comparative lightness, it will also be more easily fixed, and if more easily fixed, disease attacking the joint will be less serious and more easily curable. In this lies a partial explanation of the fact that joint diseases of the lower extremity become less serious as we pass from the hip toward the phalanges. Aside from the fact that the hip-joint has a peculiarly wide range of movement, if the entire limb were no larger and heavier than the foot, hip disease would not be more serious than ankle disease. A striking illustration of this point is the case related by Mr. Hilton,[2] in

[1] Our American Cousin, by Tom Taylor, Act I., scene 1.

[2] John Hilton: Rest and Pain, pp. 298–300. London, 1863. American Edition, pp. 178, 179. 1879.

which the patient had disease of the left knee and the left hip. Amputation, which was performed above the knee, promoted recovery at the hip by facilitating the control of the latter joint by muscular action. To quote Mr. Hilton's words: "In fact, I may say the hip-joint was cured by cutting off the leg."

Furthermore, a joint which is situated near the centre of the body is peculiarly liable to be disturbed by the movements of other members. The distal phalangeal joint is not appreciably affected by movements made elsewhere, but the hip-joint is inevitably disturbed by the movements of other parts of the body. In the words of Sir Charles Bell: "There is no rest to it; every motion of the body may be said to be accompanied with a movement of the head of the femur within its socket; even if the arm be raised, there is a change in the centre of gravity of the body, and the trunk must be poised anew upon the hip, as the centre of all our motions. It is remarkable how the slightest degree of movement in another part of the body is, as it were, necessarily accompanied with a motion of the surfaces of those bones which compose the hip joint. If ever you should see a patient suffering with acute inflammation of the hip, you will see the proof of this; for every motion of the body gives extreme pain, and proves an additional source of excitement and inflammation. It is this consideration which leads us to understand the difficulty of curing the disease." [1]

Another most serious obstacle to the successful fixation of the hip-joint is found in the fact that a reten-

[1] Loc. cit., p. 138.

tive splint acts here at a great mechanical disadvantage. If the distance from the acetabulum to the crest of the ilium were equal to that from the head of the femur to the condyles, or if, in imagination, we were to convert the pelvis and the vertebræ into a single bone, a retentive splint would doubtless be as effective in securing fixation as it is when used at the knee, or when applied to a fracture in the middle of the shaft of a long bone.[1]

In view of these difficulties, can we reasonably hope to secure fixation of this joint by so simple a method as traction? That this expectation is not entirely unreasonable, is indicated by the fact that the most remarkable result of the application of purely fixative apparatus, viz., the relief of pain, is also the result of the application of apparatus that is purely tractive. The following observations prove the anodyne quality of the simple retentive apparatus. Dr. Coates, referring to the use of Dr. Physick's hollow carved wooden splint, which extended from the external malleolus to the middle of the thorax and embraced nearly one-half of the trunk, wrote: "The patient frequently stated that he had obtained, in the night following its application, sounder sleep than for many weeks or even months previously."[2] M. Bonnet, referring to *le grand appareil*, which embraced two-thirds of the circumference of the lower limbs and the lower part of the trunk, wrote: "I have seen the pain and inflammation disappear as soon as the limb was

[1] One of the difficulties in the treatment of Colles's fracture of the radius arises from the shortness of the lower fragment. If this fragment, the carpus, the metacarpus, and the phalanges, were one piece the management of the accident would be greatly simplified.

[2] Amer. Jour. of Med. Sciences, p. 307, foot-note, February, 1831.

brought into position and held immovable." Relating a case, he wrote: "From the moment of application the pains diminished."[1] M. Philipeaux, referring to a case in which Bonnet's apparatus was applied, wrote: "The next morning I learned that the patient, who had moaned incessantly the night preceding the application, had slept calmly for four hours."[2] Mr. E. J. Chance's splint embraces the thigh and a large part of the trunk, and Mr. E. Noble Smith speaks of "the almost immediate relief from pain which the patient experiences when the splint is applied."[3]

On the other hand, the anodyne effect of simple traction is equally remarkable. It was observed by M. Blandin that on the application of extension and traction the acute pains of hip disease "disappear as if by enchantment."[4] Gustav Ross said that when the weight and pulley were used in the hip disease of children, "the pain lessens astonishingly."[5] Dr. John Watson, describing his treatment of a patient in the acute stage of hip disease, said: "I had hardly put on the counter extension before the girl was entirely free from pain. It operated beautifully and instantly."[6] Dr. E. S. Cooper, referring to his ingenious device for traction and counter-traction, writes: "Often have patients slept better the first night after its application than they had for many months previously."[7]

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[1] Traité des maladies des articulations, vol. ii., pp. 356, 361. Lyon, 1845.

[2] Traité de thérapeutique de la coxalgie, p. 250. Paris, 1867.

[3] E. Noble Smith: The Surgery of Deformities, pp. 133–135. London, 1882.

[4] Maisonneuve: De la coxalgie, Thèse de Paris, p. 228. 1844. Ann. de la chir. fran. et étrangère, vol. xiii., p. 192. 1845.

[5] Deutsche Klinik, p. 98. March 4, 1854.

[6] Am. Med. Times, p. 310. May 11, 1861.

[7] San Francisco Medical Press, p. 145. July, 1861. Dr. Julius A. Post has noted the remarkable relief afforded by the weight and pulley in a case of hip disease in an adult. Philadelphia Medical News, p. 537, November 11, 1882.

When we find, as above, that pain is controlled equally by direct fixation and by traction, can we escape the suggestion that perhaps traction is in itself an effective method of securing fixation? It has been stated as an objection to this view, that the relief which follows traction is too instantaneous to be considered as the result of fixation. It is thought to occur before immobilization could have produced any effect. In reply it may be said that the pain of hip disease is composed, to a certain degree, of extreme apprehension and mental and muscular fatigue, produced by prolonged efforts to prevent motion, with sudden sharp accessions when motion is inadvertently made, or when the patient starts in the act of falling to sleep. Such pain as this is capable of instant relief or abatement by fixation. In certain cases there is a severe pain not controlled by mechanical treatment, the occurrence of which, sometimes at least, accompanies the development of an abscess.

We have seen above that fixation has, by a number of writers, been recognized as an accompaniment of traction applied to the hip-joint. We have also seen that clinical observation renders it not improbable that traction acts as a fixative power, because its first effect is identical with that of apparatus which is purely fixative. The important question arises whether it is demonstrable that traction secures fixation. This question may be answered affirmatively. Take two rods of iron or soft steel, of sufficient length, and form an eye in the end of each by bending its extremity into a small circle. When the rods are joined by these eyes they will together resemble two links detached from a surveyor's chain, and there will be wide and free mobility at the joint. Then tie the

free end of one link to a staple and apply moderate traction, by means of a weight and pulley, to the free end of the other. It is seen at once that the mobility which existed at the joint between the links is absent so long as the traction continues.[1] Although the immobility thus produced is liable to be overcome by a competent disturbing force, it is nevertheless quite sufficient to relieve the pain of hip disease and to promote union in fracture of the long bones. But in the treatment of hip disease fixation by the weight and pulley is open to the objection that it necessitates prolonged recumbency, and is liable to wilful disturbance. Discarding for these reasons the weight and pulley, let us subject the two links of surveyor's chain to traction in a hip splint, tying the free end of one to the perineal straps and that of the other to the leather strap which leads to the foot-piece. The result of applying moderate traction by the rack and pinion when the parts are thus arranged is fixation of a remarkably stable and indestructible kind.

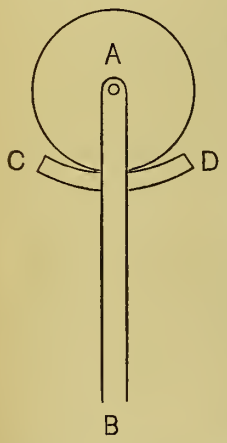
[1] In this way we arrive at a competent explanation of the efficacy of traction by the weight and pulley in the treatment of fractures, a method the antiquity of which has been traced by Mr. J. H. James (Address in Surgery, Transactions of the Provincial Medical and Surgical Association, vol. viii., pp. 213–216, 1840) and A. S. Gohier (Nouvel appareil pour le traitement des fractures du col du fémur, p. 36. Paris, 1835). The explanation which depends on the supposition that traction places the muscles on the stretch and thus makes them retentive splints is open to the objection that traction is powerless to stretch the muscles to a degree even approaching the normal lengthening to which they are accustomed in the ordinary movements of the limb. If a muscle is in extreme normal contraction, its opponents are of course relaxed and lengthened, and when the parts are at rest this potential elongation is so great that traction would be incompetent to stretch the muscles enclosing a long bone in any degree, still less to give them enough tension to qualify them for the functions of a retentive apparatus. For the same reason the efficacy of traction (continuous extension) in the treatment of fractures can hardly be said to depend on its ability to tire out the muscles whose contraction produces displacement of the fragments.

It is worthy of note, furthermore, that when the hip splint is applied to a patient traction is made in such a manner that fixation is rendered more complete by a part of the apparatus which acts as a brake. The hip splint is so well known that it does not require a description here. It is sufficient to say that the apparatus here referred to has a less flexible upright and pelvic band than have been found in some forms of the apparatus, and also a bolt and nut connecting the two parts, by the use of which they can be firmly fixed at any angle desired by the surgeon. It is provided with suspending straps passing over the shoulders, by which the adhesive plasters and the affected limb are relieved from the weight of the splint when raised in walking. It also has a U-shaped attachment [1] at the level of the lower part of the thigh, by which motion is more fully arrested than by a flexible strap.[2] The parts which act as a brake are the perineal straps. A brake is described as follows: "An apparatus used for retarding the motion of a wheel by friction on its periphery." As applied to a patient, the hip splint, when traction is exerted, makes friction on the tuberosities of the ischia and the rami of the ischia and pubes, these parts representing the periphery of a wheel revolving at the upper end of the femur through a considerable arc in the plane of flexion and extension. If friction can be made on the periphery of this wheel by a process or offshoot of the femur, motion of the pelvis on the femur (or of the femur on the pelvis) will be retarded or prevented. The perineal straps are

[1] Described in The Medical Record, p. 738, June 26, 1880.

[2] Some practical points in the management of this apparatus have been considered in the Medical Gazette, pp. 413–415, December 10, 1881.

a process of the femur inasmuch as they are carried by the pelvic band, which is immovably attached to the upright, and this latter is practically of one piece with the femur, especially if the femur is held parallel with the upright by the U-shaped piece attached at the level of the lower part of the thigh. In the accompanying figure let the circle represent the pelvis, A the acetabulum, A B the femur and the upright, and C D the perineal straps, practically of one piece with A B and applied to the ischiatic tuberosities. When traction is made by the rack and pinion, it is clear that motion at A will be retarded or prevented. In practice it is found that when traction is made, in the case of a patient to whom the hip splint is applied, motion in flexion and extension is prevented, although it may not as yet have been arrested by the disease.



Motion in adduction and abduction is also arrested to a certain degree by this apparatus — adduction by the circumstance that, as the perineal straps are both situated on the inner side of the joint, traction is abductive or in a direction away from the median line; while motion in abduction is opposed by the action of the apparatus as a retentive splint (although its action as such is feeble), applied to the outer side of the limb and pelvis, the retentive force being directed from within outward at the upper part of the thigh, and from without inward at the pelvis and the lower part of the limb.

The question here arises, whether an apparatus so well contrived for the arrest of motion in the hip-joint could not be used with advantage in appropriate cases in the treatment of fracture of the femur, a question worthy of attention because the hip splint not only secures fixation but also permits the patient to walk, a point of importance in the management of ununited fracture. It may also prove to be useful after osteotomy for deformity of the hip.

The idea that hip disease requires the same treatment as fracture of the femur is not new in medical literature.[1] M. Bonnet presented *le grand appareil* for the treatment of hip disease in 1845, although he had described it in all its details in 1839, as an apparatus for the treatment of fractured femur.[2] In the same manner, but with a longer intervening lapse of time, the complicated apparatus of M. Martin was prescribed by him in 1850 for fracture of the femur, and in 1865 for hip disease.[3] Mr. Ford compared hip disease without an external opening to a simple fracture of the bone,[4] and Sir Benjamin Brodie carried the comparison further, saying: "If it (the cartilage) be extensively destroyed without suppuration, the case may be compared to one of simple fracture; and if there be suppu-

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[1] In 1779 David de Rouen, referring to diseases of the joints, wrote that notable cures are to be effected "by allowing the parts to remain undisturbed in splints, as in the treatment of fractures." R. Philipeaux: De la Coxalgie, p. 381. Paris. 1867.

[2] Mémoire sur les fractures du fémur, Gazette Méd. de Paris, pp. 579, 580, September 14, 1839. Traité des maladies des articulations, vol. ii., pp. 322–324. Lyon, 1845.

[3] L'Union Médicale, Décembre, 1850. De la coxalgie, par Ferdinand Martin, pp. 488–496. Paris, 1865.

[4] Edward Ford: Diseases of the Hip-joint, pp. 132, 133. Second Edition. London, 1810.

ration, it may be compared to one of compound fracture ;" [1] a statement which drew from Dr. Alden March this apt inquiry: "If there be some analogy between the condition of the hip-joint in morbus coxarius, and fracture of the neck of the bone, why should there not be some similarity in the mode of treatment?" [2]

If we recall the morbid anatomy of this disease, in which the integrity of the central portion of the bone is invariably assailed, we can better understand the comparison of hip disease to a fracture of the bone, and the more readily recognize the propriety of treating it by fixation. If hip disease were synovitis, invading, under the pressure of reflex muscular contraction, first the cartilage and then the bony tissue, it would be right to try to diminish this pressure by traction, or any other method believed to be practicable.[3] We might even attempt the difficult combination of traction with mobility, in the hope that motion without friction would perhaps assist the process of repair and secure a recovery without impairment of mobility. But the disease is not synovitis. It is ostitis, beginning in the cancellous tissue, or at the epiphysal junction, excavating the bone, undermining its strength, progressing from within outward, and involving in time all the structures of the joint. In this view it is clear that the proper local treatment is protection from the pressure and concussion incident to walking, and the prevention of motion in the joint. As in a fracture, so in hip disease, the part should be placed in a favorable

[1] Clinical Lectures, p. 287. Boston Edition, 1846.

[2] Transactions of the American Medical Association, p. 503, 1853.

[3] The pathological objections to this view have been presented in the New York Medical Journal, pp. 1-17, July, 1882; the mechanical objections in THE MEDICAL RECORD, pp. 509-512, May 12, 1883.

position for the action of the natural reparative processes which, aided by appropriate general treatment, are, as a rule, able to limit this morbid process when it occurs in parts which, like the ankle, are more easily protected from disturbance and violence by the voluntary efforts of the patient.[1]

It may be said, in criticism of this precept, that the intention in treating a fracture is to abolish mobility, which, in a case of hip disease, it is our desire to retain or recall. In reply, it may be well to state that the cases of real hip disease which recover with perfect motion in the joint itself are rare, no matter what form of treatment or expectancy be pursued. There are, indeed, many cases in which the friends of the patient erroneously believe that motion of the joint has been preserved basing their opinion on the evident facility with which the patient walks. It is a common idea among non-medical observers that the limb cannot assist in locomotion if there is absence of motion at the hip-joint, while the truth is, that with a perfectly motionless hip-joint walking may be very well performed, and even with considerable grace, by reason of the acquired mobility of the lumbar region of the spinal column, and by the pa-

[1] Remarkable results from expectant treatment in disease of the ankle have been obtained by Dr. James Knight, at the Hospital for the Ruptured and Crippled. Thirty cases have been reported by Dr. T. E. Satterthwaite (Report of the Surgical Committee of the Therapeutical Society, MEDICAL RECORD, pp. 197–202, August 21, 1880) and Dr. V. P. Gibney (Caries of the Ankle in Children, American Journal of Obstetrics, pp. 434–457. April, 1880). These results have not met the appreciation which they deserve. Dr. Gibney writes (op. cit., p. 451) that in ankle disease excision "is rarely ever justifiable." He adds: "The expectant plan of treatment, fully carried out, assures us of more results that are perfect, and more limbs that are useful without the aid of support, than does any other plan known to the profession." These words give appropriate expression to a conservatism closely allied to that which crowns with honor the memory of Fergusson.

tient's unconsciously taking advantage of the motion of the unaffected hip.[1]

It is not unreasonable, however, to suppose that central ostitis occurring so near the joint as to produce all the symptoms of incipient hip disease, may, in favorable conditions and with treatment commenced sufficiently early, be resolved with perfect motion in the joint. Such cases have been observed. Patients have even been observed to recover from the third stage, with considerable useful motion in the joint. In every case, therefore, whether the disease be recent or in the third stage, the surgeon should try to secure recovery with motion, and it is important to observe that the treatment herein described not only prevents anchylosis, if it can be prevented, by subduing inflammation, but also, if anchylosis be inevitable, provides for the best position of the limb.

The fixation which this apparatus secures is of a peculiar quality. It may be compared to the condition found in some forms of paralysis, when a joint is said to resemble a leaden pipe, which may be bent with suitable force, but retains with sufficient firmness whatever position it may be placed in. This "fractional degree of fixation" is attended with sufficient arrest of motion to allay inflammation, encourage the reparative process, and afford relief from pain; and yet it is not so inflexible as to prevent the gradual correction of the deformity in obedience to the unconscious efforts of the patient to place

[1] Mr. Hilton describes one of his patients, who recovered with a firmly anchylosed hip-joint, as follows: "She is an excellent dancer, frequently dancing for a whole evening, and but few persons know, when she sits down, that the right knee-joint is bent at right angles with the thigh and body, and tucked under the chair to meet the inconvenience of her fixed hip-joint." John Hilton: Rest and Pain, p. 373. London, 1863. American Edition, p. 221, 1879.

the limb in its most useful position, which is that of slight flexion with neither adduction nor abduction. This position permits both walking and sitting with considerable facility, although the joint be motionless.

The deportment of the limb under this treatment is observed to advantage in a case that has progressed so far that the patient is confined to his bed while the thigh is in excessive flexion and adduction, and yet not so far that the structurally shortened muscles are an impediment to the reduction of deformity. Almost immediately the adduction is visibly lessened, and is succeeded in a few days by abduction, which in its turn becomes excessive, because the direction of the traction is abductive or away from the median line. But when the patient has gathered strength from the relief of pain and the ability to sleep, which are secured by fixation, and begins to walk with the assistance of the ischiatic crutch [1] furnished by the perineal straps, and with the aid of a high sole on the shoe of the unaffected side, it is seen that the abduction is, in its turn, gradually diminishing; and as the patient resumes active locomotion, still wearing the splint, the limb assumes a position neither adducted nor abducted, in which it is most favorably situated for walking.[2] And while the limb has been making these changes laterally, it will at the same time be reduced from a position of extreme to one of moderate flexion, in which it is most favorably situated for both walking and sitting. The favorable position thus acquired is retained without difficulty until recovery is assured.

[1] The question of axillary or ischiatic support has been considered in THE MEDICAL RECORD, pp. 1–3, July 2, 1881.

[2] Cases treated in this manner, in the third stage, have been reported in the Illustrated Quarterly of Medicine and Surgery, pp. 45–52, April, 1882.